

CyberSix Learning: Development and systematization of a methodology for remote teaching

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Abstract—Rapid changes, especially due to the COVID-19 pandemics, are taking place in society. Accordingly, educational methods need to adapt, in order to follow the improvement of social complexity. Therefore, this research had the purpose of investigating the application of active learning methodologies, adapted for remote teaching, in the discipline of Work Organization in Production, a subject of a Production Engineering course, from the University of São Paulo. Also, this work aimed to analyze the development of socioemotional skills together with the assimilation of technical concepts; and to systematize a new methodology, which was denominated CyberSix Learning. The investigation had a qualitative approach, an applied nature, and an exploratory objective. The research method was the case study itself. In general, students considered that the experience added value in the construction of knowledge, especially concerning critical thinking and development of the ability to give feedbacks. Some difficulties were found, such as resistance to changes, ineffective communication, group distance, and cognitive obstacles.

I. INTRODUCTION

In Brazil, even in the last decade, the educational sector has been quite resistant to the adoption of new technologies and methodologies, being, in its great majority, structured from the industrial ideals coined in the Industrial Revolution, in which teaching occurs based on content repetition [1]. The rapid social changes, driven by globalization and high connectivity, highlight the consequences of a content-based learning ecosystem, dependent on the teacher, with little interactivity and use of creativity, in addition to the lack of autonomy of the learners [2]. In this case, the educational process becomes tiring and less productive.

Thus, as an alternative to equate the educational process with social changes, Active Methodologies emerged. They began to spread in Brazil at the end of the 20th century. As a basis, the student is considered a central

figure in the learning process, and the teacher's role goes from transmitting knowledge to facilitating learning [3].

Concerning higher education in engineering, active learning methodologies might be undertaken in different ways and methods, in which the common denominators are: improvement of transversal skills, combined development between academic and professional training, procedural assessment, and greater articulation of the knowledge [4]. Besides, such methodologies are a means to train not only professionals for the job market but also dynamic, pragmatic, and active individuals capable of adapting to the constant innovations and transformations in the world [4].

Due to the COVID-19 pandemics, the world found itself immersed in a widespread crisis, unprecedented in recent global history. In this context, changes, which were already occurring rapidly, were even further accelerated. The term "liquid modernity" is used to describe the

transformations of the contemporary world, in which nothing is solid, and everything is diluted like water [5]. However, this analogy is no longer enough to represent the direction of society. The accurate definitions of the VUCA world (volatile, uncertain, complex, and ambiguous) transformed the liquidity social state definition to the gas sphere, in which everything seems to be adopting a more ethereal form, impossible to retain in the hands [6].

The compulsory closure of educational institutions in the pandemic, which forced them to use technological tools for remote education, may possibly mean a turning point in education's history [7]. The adaptation of active teaching methodologies to the online environment presents several challenges for both students and teachers, such as lack of time for preparation and adaptation to online modus operandi; teacher/student isolation (both should not feel that they are alone in the teaching and learning processes); and the urgency of new pedagogical approaches [8].

Based on the above considerations, the need to adapt the education system, regarding to social paradigm changes, is indisputable. This case study aimed to investigate the application of active learning methodologies adapted for remote teaching, in the discipline of Work Organization in Production; to analyze the development of socioemotional skills together with the assimilation of technical concepts; and to systematize a new methodology, called CyberSix Learning.

1.1 Contemporary Teaching Methodologies

Active methodologies emerged intending to integrate the multiple factors that influence the learning process, to place the student in the central role of learning itself. From this teaching strategy, linked to cognitive psychology, especially to metacognition (as a learning strategy), the importance of reflection and student autonomy in the educational process is emphasized, with the ability to know himself, learn to regulate and control the search for knowledge, seeking to be an autonomous manager of their learning [9].

Active methodologies offer students opportunities to build their knowledge through theoretical-practical activities, which instigate greater interaction between student, object, and study context, to bring academic education closer to professional performance [4]. As a general consequence, students develop transversal skills and a more active, proactive, communicative, and investigative role [10].

Among several methodological tools, some, which are already well known, as Case Study, PBL - Problem-Based Learning, PjBL - Project-Based Learning, Concept maps, Peer Instructions, Flipped Classroom, and Think Pair

Share. Other strategies and methodologies have also been developed in recent years and we address, below, those that supported the development of this work.

1.2 Self-Directed Learning (SDL)

Many terms similar to "self-directed learning" are used with the same meaning and context, such as self-regulated learning, autonomous learning, self-planned learning, self-teaching, and independent study. The differences between them are subtle, which has led to indistinct use by many researchers [11].

An initial definition of self-directed learning comes from Knowles [12], who described it as a process in which individuals take the initiative in the learning process itself and, with or without the help of others, can diagnose their needs, formulate goals, identify human and material resources to learn, choose and implement appropriate strategies and evaluate learning outcomes. The concept of self-direction for learning has undergone a careful reassessment in recent years. In this way, an important distinction emerged between the self-directed learning process and the notion of self-direction as a construction of personality [13]. To overcome the ambiguity of those two perspectives of the term "self-directed learning", Brockett and Hiemstra [13] coined the "Personal Responsibility Guidance" (PRO), a model where two related dimensions are connected in an umbrella concept: self-direction in learning. Schemed in Fig.1, it is observed that personal responsibility serves as a starting point, leading to self-direction in learning through characteristics of the teaching-learning transaction (self-directed learning) and characteristics of the learner (self-direction of the learner) [13].



Fig. 1: Personal Responsibility Orientation (PRO)

However, the PRO model has been reconfigured and adapted to convey the changes required by the transformation of time. Thus, the PPC (Person, Process, and Context) model emerged, illustrated in Fig.2.

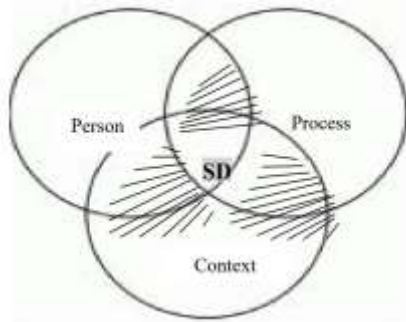


Fig. 2: Model “Person, Process and Context”

In the PPC model, the ideal situation for self-directed learning to be more effective is the one in which person, process, and context are in balance. That is, when the student is highly self-directed, the teaching-learning process is configured in a way that encourages students to take control of their own learning, and the socio-political context and the learning environment support the atmosphere for self-directed learning [14].

1.3 Diversix Methodology

Barreto [15] coined a methodology that integrates six pedagogical resources with an unusual skill used in teaching processes, which is humor. This method, called Diversix, enables the development of several skills and abilities, such as creativity, communication, capacity for analysis and synthesis, teamwork, leadership, transmission, reception and processing of information, and others.

According to this methodology, the classroom should be divided into groups of students, who are responsible for preparing presentations on topics related to the discipline. At least six pedagogical resources must be used, such as group dynamics, slide presentation, videos, cases, an individual scientific research summary about the topic, and evaluation of the entire classroom in the next class (includes preparation, application, and correction of an evaluative activity). After each presentation, the whole class and the teacher give systematic feedbacks to the responsible group [15].

1.4 Online Education

Online education is defined as the set of teaching-learning actions mediated by digital interfaces that enhance interactive and hyper textual communication practices [16]. It is not just an evolution of Distance Education, but also a phenomenon of cyber culture, term that names the socio-cultural development within the “cyberspace”, where the information portrays the main characteristic of this organization and the network flow constitutes the basis of the social structure [16].

Some fundamental principles ought to be considered for educational success, which are the virtual learning environment resources, the interactivity and collaboration between students, and the role-played by the teacher (moving out from the center of the process) [17].

1.4.1 Distance Education

There are several concepts of Distance Education (DE). Fundamentally, distance education is defined when the teaching process occurs while the teacher and the student are separated [18]. In addition, distance education involves a particular educational project, with tutors, virtual environments, and the establishment of learning objectives [19]. However, each author highlights some specific trait in his conceptualization.

Dohmen [20] emphasizes that DE is a systematic self-study, in which the student learns from the material presented to him, with supervision by teachers through the media. Peters [21] states that distance education is an industrialized way of teaching and learning. Dias and Leite [22] highlight the physical separation and the mediation of the so-called ICT (Information and Communication Technologies) in the distance learning process.

According to Moore and Kearsley [23], technology and the media have pointed the innovative evolution of distance education over five generations, as proposed:

- a) 1st. Generation (1850 - 1960) - correspondence;
- b) 2nd. Generation (1960 - 1985) - broadcast by radio and TV;
- c) 3rd. Generation (1980 - 1995) - open universities;
- d) 4th. Generation (1995 - 2005) - conference call; and
- e) 5th. Generation (2005 - until today/2020) - Internet.

It is important to highlight counterpoints to Distance Education, as it may hinder the learning process if not tackled. The virtual class does not encompass the intensity of a real class, as the teacher-student relationship must be essentially immediate, without intermediation [24]; and the ability of distance education to provide an ethical-political education for the student is also questionable, once it fails to provide the awareness of power relations present in social institutions, scientific knowledge, and professional practice [25].

1.4.2 Emergency Remote Teaching

Due to the COVID-19 pandemic, remote education has been applied on an emergency basis, since the educational projects of educational institutions and their respective courses were not planned for the distance education modality, which requires structuring the curriculum and processes to appropriate teaching methods. In this way,

teachers are using ICTs as a means of teaching, to virtualize the face-to-face model [26].

Emergency remote education is defined as a period of a sudden change from the form of educational instruction to an online model, due to some catastrophe. In this case, once the circumstances of the disaster recede, the teaching configuration will return to its original format [28].

1.5 A new strategy: CyberSix Learning

Following the methodologies and theoretical bases mentioned above, a new method was created to meet the specific needs of students, taking into account the social context triggered by the COVID-19 pandemics.

This new method is called CyberSix Learning and its authorship is equally shared between the teacher responsible for the discipline and a monitor student who had already taken the course in a previous year (2019), both authors of this article.

The pillars that underlie the construction of the methodology are:

a. Conceptual understanding of the subject

The theoretical concept of the discipline must be thoroughly worked on, to guarantee that technical apprehension occurs. In addition, the academic study should provide support for the student's development, in order to expand his knowledge and technical skills on the subject.

b. Student at the center of the learning process

The student has the autonomy to relate to the theoretical concepts of the discipline and to be actively involved in its development, in order to build knowledge, being guided by the teacher, and collaborating with the mentor, as well as the other apprentices. In this way, it presupposes and creates an environment in which there is a conscious intention to improve and learn.

c. Network interactivity and learning

In this case, the term network is a social trait, being understood as the whole flow and bundle of relationships between the subjects involved in the learning process, and the digital interfaces. The network allows students to share meanings while recognizing information and knowledge, becoming possible by the wide reach of the internet. Thus, learning occurs from teacher to student, between students, and in the student's contact within the cyberspace. Fig. 3 shows how the pillars elucidated are interrelated as elements of learning, and with the subjects of the educational process (student and teacher).



Legend:

Cyberspace

Personal choice of own development

Theoretical apprehension process proposed by the teacher

Network between students

Fig. 3 - Relational Scheme between the methodological pillars

II. METHODOLOGY

This study was carried out in the discipline of "Organization of Work in Production", given for the Production Engineering course at the Engineering School of Lorena campus (EEL), at the University of São Paulo. The class had 40 students, 36 from EEL and 4 from Polytechnic School (another campus of the University). Since it took place during the second semester of 2020, classes occurred remotely, due to the Coronavirus pandemic.

The investigation had a qualitative approach, concerned with the understanding of subjective concepts; an applied nature, proposing to investigate a specific case; and an exploratory objective, aiming to obtain greater proximity with the object of study [28].

The research method was a case study, which represents an empirical investigation and contains a comprehensive method, with the logic of data planning, collection, and analysis [29]. In addition, it allows the intense examination of an object of study in order to achieve the results [30].

Thus, the research was conducted into six stages. In the first one, the object of study was defined, concomitantly with the elucidation of the purpose of this research. Also, a bibliographic search was made about active teaching

methodologies, self-directed learning, the Diversix method, online education, and its variants.

In the second stage, based on the previous theoretical foundation, the fundamental methodology for this case study, CyberSix Learning, was coined with the planning of each class and activity.

During the third stage, the teaching strategy was applied. Thus, a Case Study was developed, using participant observation as an investigation technique, which consists of the researcher's real interaction with the object of study, in which the researcher joins the group and influences it [31].

The fourth stage happened concurrently with the third one, since data were collected and systematized as the teaching methodology became concrete.

Subsequently, in the fifth stage, there was an analysis of the data collected, made based on the Content Analysis technique [32].

The sixth step consisted of compiling the research findings and writing this article.

III. RESULTS

3.1 Before classes' start

First, a flexible schedule plan was developed to support the application of the method. The following themes to be worked on were defined, which were already part of the programmatic content of the discipline, grouped as follows: the needs of modern companies; new production models; work models of organization schools; socio-technical principles of work; group work; organization by processes; and organizational changes.

The execution strategies during classes were also planned, and the roles to be played by the teacher, monitor, and students were aligned.

Then, students received an invitation to be an active part of the discipline's learning process, by e-mail. The purpose of the invitation was to make room for the students' individual intention to commit to their own development, while studying the subject.

3.2 During classes

In the first class, an icebreaker activity was made to connect the students to each other, the teacher and the monitor as well. The chosen dynamic was an adaptation of a common game, in which the first person speaks the name of an object, and people need to show the object, as soon as possible, through the webcam. Also, whoever showed the object should also say something about themselves,

except for the following topics: age, course, city, and where they work.

The activity brought agility and interaction, in the first moment, besides promoting identification among the participants, undoing the initial tension of the unknown, and providing a less formal environment.

Continuing the class, theoretical concepts of the discipline were explained, and later the proposal for structuring the semester was placed:

a. The students could present topics that they would like to work on in the semester, but also connecting them with the mandatory menu;

b. Formation of ten groups, with four students in each;

c. Presentation of a seminar per group during the semester, lasting 1h50, and with weekly frequency. The classes had a total duration of 3h20.

Still in the first class, the groups were set up, and the additional topics, brought by the students, were discussed. The following topics were added: Industry 4.0/5.0; Agile Mindset; Duality of automation vs humanization; Non-Violent Communication; Time management; Firms of Endearment; Mental health at work; Diversity and inclusion. Subsequently, these themes were included in the discipline's schedule.

Concerning the requirements of the seminar, it should contain slides, videos, a case, dynamics, be presented by every participant of each group, and use humor. Both teacher and the monitor were available to answer questions and clarify what was necessary, but for that, the group of students would have to speak up. That is, if they needed or wanted, they could get in touch.

In the following classes, the groups presented the seminars, and, after each exhibition, a feedback session was held about the presentation with the whole class, pointing out positive aspects and aspects that needed to be improved.

For each presentation, the monitor, to enable future comparisons and support the analysis of the research procedures, wrote a descriptive record.

To end the semester, there was a lecture by an organizational designer covering the theme "Flexibility and Adaptation to Changes", aiming to bring students closer to the skills development need, due to major changes in the job market.

3.3 Perception of students

Throughout the classes, students' feedback about the discipline methodology and execution was collected, as well as a metric of individual perception of learning. The average answer of how much they consider they learned in

this subject, in comparison with other disciplines they took, whose methodology is traditional, was 4, on a scale from 1 to 5, where 5 means learning much more and 1 much less than the other disciplines.

In general, students considered the learning experience positive through the applied methodology. Some comments prove this idea:

"I would like to congratulate the teacher, who always complied with the agreement, and the monitor for her excellent work throughout the semester. I had never done a discipline with such a participative monitor, and this role of the monitor should be better explored in other subjects of the undergraduate courses at the university" [S1].

"The methodology applied was the best adaptation of the face-to-face classes for distance learning, in comparison with other subjects, this due to the interaction proposal between students in the classroom" [S2].

"This subject added me a lot, both in technical aspects of group work, as well as in my human side. I enjoyed being able to debate about the topics that were proposed." [S3].

Another gain perceived by the students was the feedback sessions after each presentation. Students were encouraged to exercise assertive communication when expressing their perspectives, in addition to encouraging critical thinking by bringing points of improvement to the classmates.

Although the methodology has as a central basis the participation of students to make a feasible network learning, there were challenges in engaging students to actively participate in the seminars. Some indicators, raised through participant observation, were:

- a. Few students opened the webcam during classes;
- b. At various times allowed for interaction, there was a general hesitation in sharing information, or asking questions;
- c. The groups responsible for the seminars did not meet the improvement's feedbacks (such as: enhancing the theoretical level of the information brought, structuring the presentation in order to have greater interaction and dynamism during the execution).

Furthermore, at the end of the semester, students' individual feedback on the applied methodology was collected. Among the points of improvement brought by the students, the following stand out:

- a. The unpreparedness of some students who did not study properly before presenting the content, and consequently, the demand for more lessons from the teacher;

- b. Lack of structured guidance on what was expected from the presentation;
- c. The methodology was based excessively on the conduct of students;
- d. The methodology was not so productive considering the context of the pandemic, due to generalized social stress;
- e. Learning differently from those who conduct the seminar compared to those who are watching, resulting in an uneven absorption of content;
- f. Although the methodology is active, the dynamics and interactivity between students represented a small portion of the class time, figuring students as passive agents of knowledge;
- g. Paying attention to a screen for 2 hours straight causes infatuation, making the learning process tiring;
- h. There was an insufficient variety of dynamics brought by the presenters, and even though the themes of each seminar were different, the classes seemed repetitive, as the format used were similar.

IV. DISCUSSION

During the semester, the students' difficulty in taking an active posture in their own learning was evident, since they showed more passivity than expected, comparing to what used to happen during face-to-face classes in this discipline. Due to the atypical nature of the academic semester, which took place during the pandemic, the hypothesis was raised that this occurred due to virtual social conformity [33], which acted in a way to put obstacles for the students' approach.

To analyze the points of improvement that were raised, the data was segmented and grouped. These were arranged in categories [32] defined as shown below.

4.1 Resistance to change

The notes reinforce a predilection for maintaining traditional learning practices. This can be attributed to the fact that active methodologies demand more effort and individual commitment to the construction of their own knowledge.

4.2 Ineffective communication

Much of the online interaction occurs by written communication, via online chat. The use of this tool is more objective, having no communicative function of debate. Oral communication, through speeches, which is frequent in classrooms, is rarer when there is a screen, such as a computer or a cell phone. In these conditions, there is a lack of deepening in the discussions raised, in addition to the impediment to the observation of non-verbal communication, leaving gaps in its ratification.

4.3 Group distancing

The pandemic context makes people focus more on themselves than on group work, due to social isolation. However, considering that the methodology demands that the group stimulate the development and good performance of its members, a gap emerges in achieving the desired results. With that in mind, as well as the previously discussed resistance to change, a question appears: how to make students understand the importance of network learning?

In addition to the physical distance, it is observed that students use the screen as a shield to hide and not to be seen by the group. Thus, students remain in the passive position, of one who receives the knowledge, instead of acting on and actively seeking their development.

4.4 Cognitive obstacles

Given the fact that the relationship created with learning itself took place more distantly and passively in the virtual environment, the following questions arise: what are the new strategies for students to develop socio-emotional skills? How to dissolve or mitigate the barriers of integration among students who are physically distant? What nuances of human behavior during human-computer interactions do we need to take into account to adjust the methodology?

There are several questions to ponder about cognition and its influence on online learning, questions that might be answered as current teaching practices consider different contexts such as those being experienced.

V. CONCLUSION

As social transformations occur, it is necessary to create strategies for the teaching and learning model to follow such changes. In this context, this case study fulfilled the objective of investigating an active learning methodology application, that was adapted for remote teaching, in the discipline of Work Organization in Production, towards analyzing the development of socioemotional skills together with the assimilation of technical concepts and systematization of the CyberSix Learning methodology.

In general, the students considered that the experience added value in the construction of knowledge, especially concerning critical thinking and the development of assertive communication. Comparing to traditional disciplines, the average response of how much they consider they learned in this subject was 4, on a scale from 1 to 5.

However, students' engagement barriers were noted, as well as the lack of an in-depth understanding of the role they should play. Among the classified difficulty points, these were found: resistance to changes, ineffective communication, group distance, and cognitive obstacles.

It is noteworthy that the application of the CyberSix Learning methodology was made in only one case and in an adverse external context, which is the pandemic of COVID-19. Hence, as future research, it is indicated to use the methodology in different disciplines and fields of knowledge, and in a post-pandemic context to compare its influence on results.

Therefore, it is suggested that other researchers, who are interested in applying the CyberSix Learning methodology, contact this research team, as a means to contribute to the construction of knowledge collectively and improvement of the method.

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